*Position-Angles of the Ring, measured with the wire micrometer.*

| 1891. | M.T. Utrecht. h m | Pos. Angle. ° ′ | Naut. Alm. ° ′ | Corr. of N.A. ′ |
|---|---|---|---|---|
| June 24 | 8 57·5 | −5 15·0 (5) | −5 34·7 | +19·7 |
| 26 | 8 44·7 | −5 11·0 (4) | −5 34·1 | +23·1 |
| 28 | 8 51·5 | −5 6·5 (5) | −5 33·45 | +26·95 |
| July 4 | 8 43 | −5 48·0 (5) | −5 31·4 | −16·6 |
| 5 | 8 37·5 | −5 26·5 (5) | −5 31·0 | + 4·5 |
| 10 | 8 24·6 | −5 41·5 (3) | −5 29·0 | −12·5 |
| July 1 | 12 43·1 | −5 24·7 | −5 32·3 | + 7·6 |
| | =12 22·6 M.T.Gr. | | | |

The numbers in brackets indicate the numbers of measures, which, however, have not been taken into account in deducing the mean.

*Utrecht:*
1891 *December* 14.

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*Observations of Occultations of Stars by the Moon, and of Phenomena of the Satellites of Jupiter and Saturn, made at Mr. E. Crossley's Observatory, Bermerside, Halifax, in the year* 1891. By J. Gledhill.

*Lunar Occultations.*

1891 January 17.—$\xi$ *Arietis.* Disappearance, G.M.T., $11^h\ 3^m\ 20^s{\cdot}5$. Time by *N. Almanac*, $11^h\ 5^m$. Definition not good.

1891 March 26.—$l^2$ *Virginis.* Disappearance, $10^h\ 3^m\ 8^s$. Time by *N. Almanac*, $10^h\ 1^m$. Stormy.

1891 April 18.—42 *Leonis.* Disappearance, $10^h\ 27^m\ 56^s$. Time by *N. Almanac*, $10^h\ 35^m$.

*Phenomena of Jupiter's Satellites, observed with the* $9\frac{1}{3}$*-inch Cooke Equatorial Refractor.*

| Date. 1891. | Satellite and Phenomena. | | G.M.T. of Observation. h m s | Time by Nautical Almanac. h m s |
|---|---|---|---|---|
| Aug. 22 | I. Ec. D. | Began to fade. | 10 6 30 | 10 10 17 |
| | | Half gone. | 10 8 | |
| | | Last seen. | 10 10 58 | |
| 29 | I. Ec. D. | Began to fade. | 12 3 | 12 5 14 |
| | | Half gone. | 12 4 30 | |
| | | Last seen. | 12 5 45 | |

| Date. | Satellite and Phenomena. | | G.M.T. of Observation. | Time by Nautical Almanac. |
|---|---|---|---|---|
| | | | h m s | h m s |
| 1891. Sept. 6 | I. Tr. I. | Outer contact. | 11 9 | 11 9 |
| | | Bisection. | 11 11 30 | |
| | | Inner contact. | 11 13 30 | |
| 8 | II. Tr. E. | Inner contact. | 10 43 | 10 48 |
| | | Bisection. | 10 45 30 | |
| | | Outer contact. | 10 47 | |
| | II. Sh. E. | Inner contact. | 10 55 | 10 58 |
| 10 | III. Tr. E. | Half off. | 10 49 | 10 51 |
| | | Just off. | 10 52 | |
| 28 | IV. Ec. R. | First seen. | 11 47 1 | 11 48 19 |
| 29 | I. Tr. I. | Outer contact. | 10 47 | 10 47 |
| | | Inner contact. | 10 50 | |
| | I. Sh. I. | Just within disc. | 11 26 | 11 23 |
| 30 | I. Ec. R. | First seen. | 10 58 | 10 57 57 |
| | | Full. | 11 3 | |
| Oct. 7 | I. Oc. D. | First contact. | 9 50 | 9 50 |
| | | Half gone. | 9 52 | |
| | | Just gone. | 9 54 | |
| | I. Ec. R. | First seen. | 12 53 43 | 12 53 23 |
| 9 | I. Ec. R. | First seen. | 7 22 27 | 7 22 12 |
| 10 | II. Tr. I. | First contact. | 6 14 | 6 17 |
| | | Half on. | 6 16 | |
| | | Just within. | 6 18 | |
| 12 | III. Oc. D. | First contact. | 10 28 | 10 30 |
| | | Bisection. | 10 31 | |
| | | Just gone. | 10 34 | |
| 15 | I. Tr. I. | First contact. | 8 46 30 | 8 46 |
| | | Bisection. | 8 48 | |
| | | Just within. | 8 50 | |
| 16 | I. Ec. R. | First seen. | 9 17 53 | 9 17 43 |
| | | Full. | 9 22 | |
| 19 | II. Ec. R. | First seen. | 7 37 59 | 7 37 49 |
| | | Full. | 7 42 | |
| 23 | IV. Tr. E. | Half off. | 6 48 | 7 7 |
| | | Outer contact. | 6 50 | |
| | III. Tr. E. | Half off. | 7 10 | 7 16 |
| | | Outer contact. | 7 18 | |

| Date. | | Satellite and Phenomena. | | G.M.T. of Observation. | Time by Nautical Almanac. |
|---|---|---|---|---|---|
| 1891. | | | | h m s | h m s |
| | | I. Oc. D. | Outer contact. | 7 50 | 7 53 |
| | | | Just gone. | 7 55 | |
| | | I. Ec. R. | First seen. | 11 13 47 | 11 13 17 |
| | | | Full. | 11 18 | |
| Oct. | 24 | I. Sh. I. | Just within. | 6 9 | 6 6 |
| | | I. Tr. E. | Half off. | 7 17 | 7 20 |
| | | | Outer contact. | 7 20 | |
| | | I. Sh. E. | Inner contact. | 8 20 | 8 24 |
| | | | Half off. | 8 24 | |
| | 30 | III. Tr. I. | First contact. | 7 28 | 7 27 |
| | | | Bisection. | 7 31 | |
| | | | Inner contact. | 7 35 | |
| Nov. | 2 | II. Oc. D. | First contact. | 7 36 | 7 39 |
| | | | Bisection. | 7 38 | |
| | | | Just gone. | 7 40 | |
| | 17 | III. Oc. R. | Outer contact. | 8 22 | 8 21 |
| | 20 | II. Ec. R. | First seen. | 7 24 12 | 7 23 26 |
| | | | Full. | 7 29 | |
| Dec. | 2 | I. Tr. E. | Outer contact. | 5 43 | 5 39 |
| | 4 | II. Oc. D. | Contact. | 7 7 | 7 7 |
| | | | Just gone. | 7 10 | |
| | 6 | II. Sh. I. | Inner contact. | 5 5 | 5 2 |
| | | II. Tr. E. | Outer contact. | 5 12 | 5 10 |
| | 16 | III. Ec. R. | First seen. | 5 37 17 | 5 36 44 |
| | | | Full. | 5 40 | |
| | 17 | I. Ec. R. | First seen. | 8 8 12 | 8 9 26 |
| | 22 | II. Ec. R. | First seen. | 7 13 7 | 7 12 51 |
| | | | Full. | 7 17 | |
| | 29 | II. Oc. D. | Contact. | 4 31 | 4 34 |
| | | | Last seen. | 4 34 | |

*Notes.*

August 22.—Planet low. Much motion.

September 6.—Definition poor. Too much motion for any useful observation of the transit of the shadow.

September 8.—Cloudy. Poor definition. Impossible to see when the shadow was just off the disc.

September 10.—Planet too low for the first two observations given in the N.A. Definition bad. The shadow of III was a very striking object during its transit.

September 28.—Furious wind. Often cloudy.

September 29.—Bad night. Cloudy and windy. Clear now and then.
September 30.—Fair definition.
October 6.—Very bad sky.
October 7.—Very good definition, but seldom clear.
October 10.—Fair sky.
October 12.—Pretty good definition.
October 15.—Furious wind. Very bad definition. The sky cleared suddenly at 8.30 P.M.
October 16.—Poor definition.
October 19.—Much motion.
October 23.—Fair definition.
October 24.—Bad sky.
October 30.—Calm. Very misty. Steady images.
November 2.—Good definition.
November 17.—Violent motion.
November 20.—Good sky.
December 2.—Bad definition. Power 150. Definition not good enough for observing the shadow.
December 4.—Much motion.
December 6.—Much motion.
December 16.—Violent motion.
December 17.—Misty.
December 22.—Misty.
December 29.—Stormy.

## *Dark Transits of Jupiter's Satellites &c.*

1891 September 29.—I began its transit about $10^h\ 48^m$. It soon faded away and was invisible at $11^h\ 15^m$; also at $11^h\ 40^m$.

1891 October 6.—Sky began to clear at 10.30 p.m.

IV was near the limb at $11^h$ and quite grey. It was in outer contact probably about $11^h\ 30^m$. Very bad sky.

At $11^h\ 30^m$ I was near the limb and much fainter than it was at $11^h$.

1891 October 7.—I was quite bright up to its disappearance.

1891 October 10.—II did not appear to lose brightness as it approached the limb of *Jupiter*. When just on the disc it was a bright object. Was invisible at $6^h\ 40^m$, $7^h\ 15^m$, and $7^h\ 30^m$.

1891 October 12.—III did not appear to lose brightness as it approached the planet.

1891 October 15.—I is not as bright as the limb of the planet. IV and II appear much less bright than III.

1891 October 23.—$5^h\ 30^m$ *Jupiter* low; misty. IV in transit, and as dark as a shadow. III is also in transit; is smaller and not so dark as IV. The former is projected against a southern grey band; the latter is in a southern bright zone.

III was central about $5^h\ 30^m$.

$6^h\ 30^m$, both satellites dark as above, IV being not far from the limb.

$6^h\ 45^m$, IV invisible. III is dark yet.

$6^h\ 48^m$, IV half off and as bright as the limb of the planet.

$6^h\ 50^m$, III faint. At $7^h\ 5^m$ IV looked dim and strikingly less bright than I, which was approaching the disc. III invisible. At $7^h\ 10^m$ III was half off and quite as bright as the limb. When III and IV got away from the limb into the dark sky, their difference in size and brightness was very striking. The two were near together.

1891 November 17.—$8^h\ 30^m$, IV is strikingly faint, although it is not far (about $\frac{1}{4}$ of the diameter of *Jupiter*) from the limb.

1891 December 2.—I will come off the disc at $5^h\ 39^m$. It is now (5 P.M.) invisible, but the shadow is well seen. The satellite was not seen till nearly in inner contact, when it was about as bright as the limb of the planet, and it was very faint after it passed off the disc.

1891 December 4.—II was near the planet at $7^h$, and grew faint as it approached the limb.

1891 December 5.—III dark during transit. At $5^h$ dark but not black. So also at $5^h\ 30^m$. Invisible at $6^h$. Egress at $6^h\ 21^m$ not seen owing to wind and cloud.

1891 December 6.—II in transit. Invisible at $4^h\ 50^m$ and at $5^h$.

1891 December 16.—I in transit. At $8^h$ invisible. At $9^h$ seen as a grey spot.

1891 December 92.—II became very faint as it approached the planet at $4^h\ 20^m$ and $4^h\ 30^m$.

IV began its transit at $2^h\ 36^m$. At $4^h$ and $4^h\ 30^m$ and $5^h$ it was a dark grey, large, diffuse spot and not circular. It was not visible at $6^h\ 15^m$, nor at $6^h\ 30^m$. Clouds prevented further observation.

## *Phenomena of Saturn's Satellites.*

The weather in January and February was very bad, and no observations could be obtained.

1891 March 12.—Fair definition. Watched *Enceladus* near east end of ring. At east elongation at $10^h$.

*Tethys* pn. Just under western end of ring. Not up at $9^h\ 15^m$; past at $9^h\ 20^m$.

*Enceladus* ps. Very difficult owing to cloud. Up between $10^h\ 20^m$ and $10^h\ 28^m$; past at $10^h\ 30^m$.

1891 April 16.—Bad sky. *Rhea* w. Up between $8^h\ 50^m$ and $9^h\ 5^m$; thought to be in line at $9^h$.

*Tethys* w. Not up at $11^h\ 40^m$; past at $11^h\ 52^m$. Up between $11^h\ 45^m$ and $11^h\ 50^m$.

1891 April 17.—*Tethys* e. Misty. Satellite seen occasionally; judged in line between $10^h\ 10^m$ and $10^h\ 20^m$.

*Enceladus* very difficult owing to mist in air. Judged in line at $11^h\ 55^m$.

1891 April 22.—*Tethys* ps. In line with end of ring between $11^h\ 20^m$ and $11^h\ 30^m$.

1891 May 4.—*Rhea* w. Saw satellite occasionally. Nearly up at $10^h\ 25^m$.

1891 April 23.—*Tethys* fn. Up at $10^h\ 15^m$.

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## *Observations of Occultations of Faint Stars during the Total Eclipse of the Moon on 1891 November 15, made at the Royal Observatory, Cape of Good Hope.*

(*Communicated by David Gill, LL.D., F.R.S., H.M. Astronomer at the Cape of Good Hope.*)

In compliance with the request of Professor Döllen, conveyed by letter, preparations were made for observing the occultations of faint stars by the Moon during its total eclipse on November 15. Professor Döllen's circular, which accompanied his letter, gave the predicted Greenwich mean times of eleven disappearances and eight reappearances which might be observed at the Cape, together with the data for checking the accuracy of the predicted phenomena. These predictions, which had been obtained by a graphical process, were recomputed and found to be correct. The largest available instrument at this Observatory—the 10-inch guiding telescope of the photographic equatoreal—was used by Dr. Gill. The eye end of this instrument is fitted, not with the usual position micrometer, but with an eye-piece mounted on two slides at right angles to each other, by one of which the eye-piece can be displaced from the axis nearly $1°$ + or − in declination, and by the other to the same amount east or west of the axis. The amount of displacement is read off by finely divided scales. It was thus necessary to provide means for keeping the centre of the Moon coincident with the axis of the telescope, so that the centre of the eye-piece could be set by means of the scales (the proper readings having been previously computed) to the precise point of disappearance, and specially of reappearance of the star at the Moon's limb.

For this purpose an eye-piece of 2 inches focal length was adapted to the cover of the dark slide of the photographic telescope. The field of this eye-piece was about 34 inches in diameter, so that Mr. Woods found no difficulty, with the aid of the slow motions in R.A. and Decl., in keeping the Moon's centre in coincidence with the axis of the telescope during